day 42

HW 3.9/77-78
3.10/13-16, 31-32, 36-38
3.11/1-8

due Wed 10/30

3.9/85-87, 93
3.10/19-22, 43-44, 47, 51-53
3.11/9-12

due Thurs-Fri 10/31

3.7/101
3.8/74-75
3.9/15-17

3.10/23-26, 54-55, 59-61
3.11/13-18
4.1/1-5

all due Fri-Mon 11/4

day 42

3.9/69 a) The derivative of $\log_2 9 = \frac{1}{9 \log 2}$

$\frac{d}{dx}(c) = 0$

$= \frac{\ln 9}{\ln 2}$

Ex 5.2

$\log_2 9 = x$

$\ln(2^x = 9) \Rightarrow x \ln 2 = \ln 9$

$x = \frac{\ln 9}{\ln 2}$

b) $\ln(x+1) + \ln(x-1) = \ln(x^2-1)$ for all $x$.

False let $x = 0$

c) $2^{x+1} = e^{2\ln(x+1)}$

$2^{x+1} = e^{\ln 2^{x+1}}$

$= e^{(x+1)\ln 2}$

FALSE

d) $\frac{d}{dx}(\sqrt{2}^x) = x\sqrt{2}^{x-1}$

NOT just FALSE, but idiotically FALSE

Power Rule
x is in the base
exponent is a constant

Exponential Fn Rule
x is in the exponent
base is a constant

Logarithmic Differentiation Technique
x is in the base
x is in the exponent

e) $\frac{d}{dx}(x^{\sqrt{2}}) = \sqrt{2}\, x^{\sqrt{2}-1}$

true!

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day 42

Logarithm

$$\frac{d}{dx}(\ln x) = \frac{1}{x}$$

Actually

$$\frac{d}{dx}(\ln|x|) = \frac{1}{x}$$

$$\frac{d}{dx}(\log_b|x|) = \frac{1}{(\ln b)(x)}$$

no surprise

$$\frac{d}{dx}(\ln x) = \frac{d}{dx}(\log_e x) = \frac{1}{(\ln e)x} = \frac{1}{x}$$

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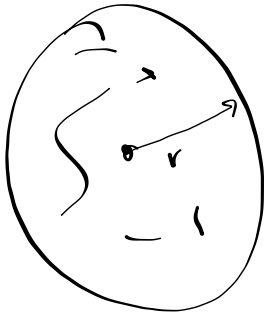
3.11/example 1 day 42

An oil rig springs a leak in "calm seas" and the oil spreads in a circular patch around the rig. If the radius of the oil patch increases at 30m/hr, how fast is the area of the patch increasing when the patch has a radius of 100m.?

step1: picture




step2: an equation that is true at every time.

$A = \pi r^2$

step3: take the derivative w.r.t. $t$

treat $A$ like $A(t)$

treat $r$ like $r(t)$

$\frac{d}{dt}(A) = \frac{d}{dt}(\pi r^2)$

$\frac{dA}{dt} = \pi\left(2r\frac{dr}{dt}\right) = 2\pi r\frac{dr}{dt}$

step4 Now, and ONLY NOW, substitute in

$\frac{dA}{dt} = 2\pi(100)(30) = 6000\pi \frac{m^2}{hr}$

Related Rates

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day 42

3.9/52) determine whether the graf of $y = x^{\sqrt{x}}$ has any horiz tangent lines

step 1 find derivative

$$\ln y = \ln\left(x^{\sqrt{x}}\right) = \sqrt{x}\ln x$$

$$\frac{d}{dx}(\ln y) = \frac{d}{dx}\left(\sqrt{x}\ln x\right)$$

$$\frac{1}{y}\cdot\frac{dy}{dx} = \frac{d}{dx}\left(\underset{x^{\frac{1}{2}}}{\sqrt{x}}\right)\cdot\ln x + \sqrt{x}\,\frac{d}{dx}(\ln x)$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{1}{2}\frac{1}{\sqrt{x}}\cdot\ln x + \sqrt{x}\left(\frac{1}{x}\right)$$

$$\frac{dy}{dx} = y\left[\frac{\ln x}{2\sqrt{x}} + \frac{\sqrt{x}}{x}\right]$$

step 2 horizontal tangent means slope = 0

$$0 = y\left[\frac{\ln x}{2\sqrt{x}} + \frac{\sqrt{x}}{x}\right]$$

$$\frac{\ln x}{2\sqrt{x}}\cdot\frac{\sqrt{x}}{\sqrt{x}} + \frac{2}{2}\cdot\frac{\sqrt{x}}{x}$$

either ~~$y=0$~~ or

$$\sqrt{x}\ln x + 2\sqrt{x} = 0$$

[find common denominator, set num = 0]

$$\sqrt{x}(\ln x + 2) = 0$$

either $\sqrt{x} = 0$ [[$x = 0$]] ~~$\times$~~

or $\ln x + 2 = 0 \Rightarrow \ln x = -2 \Rightarrow x = e^{-2}$

step 3 check in original

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